rises to the horizontal, and the resistance is thus at a maximum; towards the end of the movement, when the muscle is fully contracted and therefore weak again, the lever rises nearly to the vertical, and the resistance is therefore again small. This correspondence beween the power of the muscle and the magnitude of the resistance throughout the movement is an essential feature of the Zander apparatus, and explains its success in the treatment of muscular paresis. It requires great skill to preserve this proportion when resistance movements are given by hand. It is unquestionable that the best way to restore the power of weakened muscles is to exercise them. Massage, so often prescribed for this purpose, is comparatively of little value.

Many of the cases of injury are sent for treatment by the surgeons concerned in the administration of the Workmen's Compensation Act. An institution of this nature provides a means of giving the necessary treatment under supervision; and cases the genuineness of whose symptoms is doubtful can be kept under observation. In Germany many Zander institutes are supported by funds provided by the public bodies administering the Insurance against Accident Act of that country.

Chronic joint affections.—Many cases of rheumatoid arthritis and osteo-arthritis are treated, with good results in suitable cases. The most favourable cases are those in which the acute phase of the disease is past. The treatment is directed to the correction of deformities, the increase of mobility in the joints, and the restoration of wasted muscles. Passive movements are chiefly used. The range of tolerable movement in the affected joint is ascertained, and this, at intervals, is very gradually increased. Painful and violent movements are apt to bring about a local recrudescence. In certain cases vibrations are useful. This last method of treatment has stood the test of time in Sweden, and is of real value, notwithstanding the discredit cast upon it by the absurd pretensions of quacks. Cases of chronic articular gout have also been treated with success.

Affections of the nervous system.—In *hemiplegia* considerable increase in muscular power may often be obtained by means of graduated active movements. Passive movements are used for the correction of contractures. In *neurasthenia* the treatment has been found of much value. Ordinated daily exercise results in improved appetite and sleep; special movements are given (when indicated) for improving deficient respiratory power or remedying constipation. Vibrations often relieve the distressing cranial or abdominal subjective symptoms. In *neuritis* the mechanical treatment has proved of less value than manual treatment.

Scoliosis.—Good results have been obtained by combining the Zander treatment with the movements of the usual Swedish medical gymnastics.

Cardiac disease.—Treatment by movements is not much used in England for this condition, but the few cases treated have done well. The scope of the treatment cannot be discussed here. In outline it resembles the "mountain-climbing cure." Mechanical therapeutics possess the advantage of being easily available, and of being susceptible of exact dosage.

Chronic pulmonary affections.—In certain cases the treatment is of value in maintaining the elasticity of the thorax or in restoring its shape (e.g., after pleural effusion). Movements designed to improve the inspiratory or expiratory power may be given as indicated.

General Policy and Method of Conduct of the Institute.

The conditions mentioned above show that mechanical therapeutics possess a considerable field of utility. It has been realised that the usefulness of the institution depends on the coöperation of the practitioners of the neighbourhood. No cases whatever are received for treatment except through the introduction of a medical man. Both free and paying patients are treated, special hours being reserved for the latter. Patients of limited means are treated at reduced fees, upon the recommendation of the medical men sending them for treatment. Hitherto, this plan has worked well. The sums received in fees are to be devoted to the general purposes of the Institute. In addition to the patients sent by practitioners, cases are sent for treatment from the out-patient department of the Sheffield Royal Hospital and the Royal Infirmary. The Institute is to be controlled by an influential committee, upon which the medical profession is adequately represented.

The staff consists of a medical director and three trained Swedish masseurs (one male and two female), who act as instructors in addition to performing massage. There are also two untrained attendants. Such a staff is capable of dealing with about 120 patients a day. The number of staff required obviously depends largely on the nature of the cases. In Sheffield the cases treated are mostly of a severe nature. The grave affections of an industrial and mining population require (though they do not always obtain) more attention than the minor ailments of the members of the leisured classes who frequent such institutes at Continental spas.

The structure of the Institute and the apparatus have been presented to the city of Sheffield by Mr. Wm. Edgar Allen of that city, who has undertaken to defray the cost for a period of three years. After that time, hopes are entertained that the Institute will be self-supporting by means of public subscriptions and the fees obtained from paying patients. However that may be, the three years will enable the profession of Sheffield to form an opinion upon the value of a method of treatment which has hitherto perhaps not aroused sufficient interest in this country.

THE METROPOLITAN HOSPITAL SUNDAY FUND AND ST. GEORGE'S HOSPITAL.

WE have had given to us for publication the following report made by Sir Thomas Crosby, M.D., Lord Mayor of London, to the Metropolitan Hospital Sunday Fund, of which he is President, with regard to the methods of expenditure at St. George's Hospital. On receipt of this report the committee of the Fund made an award to the hospital. The situation is commented on in a leading article this week.

SIR THOMAS CROSBY'S REPORT.

The committee of the King's Hospital Fund have withheld their grant to St. George's Hospital on the ground that the amount expended upon the bacteriological and pathological departments is excessive and much larger than the proportion spent thereon at other hospitals.

In order to carry out my undertaking at the last meeting of the Metropolitan Hospital Sunday Fund I visited the hospital on Feb. 12th, when I was met by the treasurer and some of the house committee, who placed before me an account of the work done in those departments, the cost of their maintenance, and the amount represented by that cost per occupied bed. Statistics obtained from other hospitals showing this proportion were also produced for comparison. It was pointed out that the work of these departments is essential for the proper diagnosis and treatment of the patients of the hospital; that it is necessarily undertaken by skilled experts; and that in St. George's Hospital all reports on clinical material are furnished personally by the bacteriologist and pathologist to the hospital, and not by students, or even by house physicians or house surgeons. The work includes examinations of blood, excretions, sputum, &c., post-mortem examinations, and the examination of various growths and tissues; the preparation of vaccines, &c., besides the care of the museum, which is the property of the hospital; also a variety of chemical examinations.

A careful investigation of the whole matter convinced me that the bacteriological and pathological departments of St. George's Hospital are doing work which is recognised at all efficient hospitals as essential to the scientific diagnosis and treatment of disease; that the amount expended upon it is in no way excessive, and does not represent a larger cost per occupied bed than is the case at many other London hospitals, although, as the accounts of these departments are not kept in a corresponding manner at different hospitals (various items being excluded, or included), it is difficult to show this in exact figures. The work of these departments is as necessary to the welfare of the patients as that of the electrical department, the X ray investigations, or the preparation of drugs; and it involves most laborious processes, which can only be efficiently carried out by skilled and highly trained officers, with appropriate salaries.

I am of opinion, after an investigation of all the facts, that the proportionate amount paid by the hospital and school for the upkeep of the laboratories is a fair and proper one, and that the sums expended upon these departments by the hospital are properly taken from the general funds, being for the direct treatment of the patients.

THE INTERNATIONAL CONGRESS ON TUBERCULOSIS AT ROME.

(FROM OUR SPECIAL SANITARY COMMISSIONER.)

Rome, April 12th.

HEAVY rain and gusts of icy wind from the snow-clad Apennines, with but an occasional gleam of hot sunshine, did not (on April 10th) afford glad welcome to the early arrivals. Fortunately, these were not numerous, and it was hoped the weather would mend before the great crowd of members reached Rome. Already more than 2500 names were inscribed. They would not all come; but others not yet announced were sure to make up their minds at the last moment. A large gathering was therefore confidently expected. In the meanwhile the business committee of the annual International Conference on Tuberculosis met at 10 A.M. on the 10th, and though they had nothing but purely business matters to discuss, the meeting did not break up till after 1 o'clock. M. Léon Bourgeois, the President, was unfortunately unable on account of ill-health to attend, and deputed Professor A. Calmette, of the Pasteur Institute, to take his place. But the general secretary, Professor Gotthold Pannwitz, was present and took the chair. Among the various business matters treated, it was decided that the conference should meet next year at Berlin and the year following at Berne. At night there was a friendly gathering at the Hôtel Quirinal, and on April 12th and 13th the general discussions of the Conference will take place.

Problem of Nationalisation.

To return to the Congress, which is to be solemnly inaugurated on the 14th, no less than 31 different national units will be represented. But if we count the individual States within these units, such as those of the United States of America, and Hungary within Austria, whose governments are specially represented, no less than 56 States are sending members to the Congress. This problem of governments and nationalities has always caused much trouble at the congresses, imposing political questions on a scientific gathering, and these are not at all welcome. Thus, at the last great Medical Congress the Poles claimed the right to separate representation, and the Hungarians strongly object to see the identity of their kingdom lost in the Austrian Empire. But the members of the Congress come to discuss tuberculosis, not the merits of the various home-rule claims. Nevertheless, and in spite of this obvious desire and necessity of avoiding all disputatious political problems, these questions come up over and over again with the regularity of clockwork.

Historical Associations of Place of Meeting.

Round the castle of St. Angelo there are spacious grounds where various exhibitions can be held and ample space exists for the establishment of tent and hut hospitals. There is also a long succession of rooms where a garrison used to be lodged. All these are now vacant and serve very well for committee rooms and for smaller meetings. A press bureau is already established, with courteous attendants eager to give information. These barracks were built at the beginning of the eighteenth century, have only one storey, and give on to a sheltered arcade. Here meals will be served under cover, but in the open air, during the Congress. The whole of the castle is thrown open gratuitously to the members of the Congress, and it will need several hours of climbing up stairs and walking through long, dark, sinister passages before all this great fortress, prison house, and palace can be seen and appreciated. The whole place is most romantic and picturesque. It recalls some stirring periods of history, and it will not be altogether easy to think of the scientific problems the Congress has met to elucidate when surrounded by so many dramatic historical souvenirs. There will be a tendency to go to see the rooms in the castle that various Popes inhabited, and the batteries they built and the quaint old artillery with which they were manned. There are the dungeons, the splendid view from the top, the dark passages and Roman burial-place below. The art of Michelangelo and of Raphael contributes to decorate the residential portion of the castle, inhabited by Alexander VI., Clement VII., and other Popes. Fortunately, there will be no morning sittings, so the members should have time to see many things without neglecting the work of the Congress.

Meeting of Tenth International Conference.

On April 11th the Tenth International Conference met for general discussion both morning and evening. They sat in the Pauline Hall, high up, almost at the very top of the great castle of St. Angelo. It was necessary to ascend a spiral road built within the huge tower, and such low broad steps as horses might easily climb. The sombre roadway is lit here and there, and occasionally gives on to a terrace or battlements still armed with quaint cannon several centuries old. At last the balcony of Julius II. is reached, whence there is a commanding view of the Eternal City. Before attaining this altitude, the members pass historical prison cells where great celebrities in art and politics, as well as ordinary criminals, used to be incarcerated. These cells, devoid of light and with but little air, are striking illustrations of the progress which humanity has made, for to-day the worst of criminals would have better sanitary conditions in his prison. In Benvenuto Cellini's cell there are still traces of a charcoal drawing he attempted to make upon the wall. The Council Hall, or Pauline Hall, is a part of the apartments the Popes occupied when, for motives of personal security, they elected to live in the castle. The walls and ceilings are one mass of paintings by artists of the Raphaelesque school. The scenes depicted are mainly from Roman or Greek mythology, and all the figures are muscular and robust, and seem to protest against any idea of asceticism. The hall is oblong in shape, and instead of the platform being placed across one end it was situated in the centre and had a table in the middle. There was nothing to distinguish the chairman's seat from that of any of the other members of the committee sitting round the table. As many of the audience were behind the chairman as in front of him, and altogether it appeared more like a family gathering than a conference.

A Revolutionary Proposal.

The modest dimensions of this gathering did not deter Professor Calmette, director of the Pasteur Institute at Lille, from making quite a subversive proposition. This consists of nothing more or less than the total suppression of the international congresses against tuberculosis, and their replacement by the Conference. At first sight this rather sounds like proposing that a mouse should devour an elephant. The Conference did not seem to be more than a section meeting of one of the great international congresses; but it is just because these congresses, those of Hygiene, of Tuberculosis, and the Medical Congresses are so very huge that the need of some alteration has long been felt. Now we have a definite proposal, the substitution of conferences for congresses. At a congress all and sundry are admitted, with the result that from 2000 to 6000 persons may attend. But few cities are large enough or possess the financial means of receiving such a crowd of guests. The number of members of the present Congress that opens its sittings on Sunday will not fall far short of 3000, representing, as already stated, 31 different national units and 56 different States. The Conference list of membership gives from the United States of America, 7 members; Belgium, 8; Brazil, Bulgaria, Denmark, Greece, Monaco, and Servia, 1 member each; Portugal, Roumania, Sweden, and Spain send 2 members; Germany heads the list with 35 members, and France comes second with 15 members; Austria 9, Italy and Norway 7, Russia 6, Great Britain and Switzerland 5 each, and Hungary 3. Altogether there are, with the president and secretary, 127 members, and this little group proposes to swallow up the thousands that attend the great international congresses. But if this should be done what is to prevent the conferences of the future becoming as large as the congresses of the past? The answer is that none can attend a conference unless they are invited. The national committees would decide who should be invited and would exclude those who come for mere purposes of advertising some drug or special remedy, or themselves. What has to be remembered here is that however obnoxious the presence of such persons may be, they are not very numerous. The vast majority of the members attending a congress, especially if they have come from some considerable distance, are really interested in the object held in view. Would it be wise to keep them away? Would not the gate thus be shut to many

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days were warmer than in London, the mean maximum being 56°, but the nights were rather colder than at Westminster. In the south-west of France, at Biarritz, there were 16 days with rain, and owing to frequent strong winds from west and north-west the warmth was barely up to the March normal. At Biarritz the average afternoon had a temperature of 59° or 6° above the mean at Westminster and Greenwich, while the mean night temperature was also 6° higher than that at Westminster. On the Riviera there were some heavy downpours of rain, but they were not frequent enough to spoil the pleasure of outdoor life. At Nice the total rainfall was no less than 8·4 inches, but it all fell on ten days, leaving 21 days bright and sunny. The Riviera generally was a little warmer than Biarritz during the day and a little colder at night. In Italy and the various islands of the Mediterranean the temperature underwent a fairly gradual increase, until towards the end of the month it became quite springlike. During the early days the thermometer had considerable difficulty in rising to 60° at all regularly, but finally it marked readings about as high as those of a fine May in England, the figure of 70° being reached on several occasions and sometimes surpassed. Rain was not uncommon, but the wet periods were mostly brief and separated by many days of fair or cloudless weather. In Algeria spring became thoroughly established. Day after day the shaded thermometer rose to some point between 65° and 75° on the coast and to a higher figure inland. Rain was seldom experienced, and the sky was much more often clear than cloudy. So far as the climate of the coast of Algeria can be compared to that of this country it resembled a fine early June in the south-east of England.

INTESTINAL PERFORATION IN CONVALESCENCE FROM TYPHOID FEVER SIMULATED BY PNEUMONIA.

THE fact that it is easy to mistake thoracic for abdominal disease was known to the older physicians, but was forgotten in recent years until attention was called to it in our columns by the late Mr. H. L. Barnard.[1] He reported cases in which pneumonia, pleurisy, and pyopneumothorax simulated acute abdominal conditions, such as acute appendicitis and perforative peritonitis. Abdominal pain, tenderness, and rigidity may be "referred" consequences of thoracic disease, because the lower intercostal nerves supply the abdomen as well as the thorax. In the *Australian Medical Journal* of Jan. 27th Dr. W. R. Groves has reported a very interesting case in which the simulation was increased by the fact that the patient was convalescing from typhoid fever. A girl, aged 20 years, had passed through a severe but uneventful attack of typhoid fever in the Kyneton Hospital. One day, when the temperature had been normal for three weeks, she had a breakfast of bread-and-butter, milk, and an egg at 8 A.M. Two hours later she was seized with violent pain, at first in the left shoulder and side, but quickly shifting to the upper abdomen. The resident surgeon found the whole abdomen board-like and tender, particularly in its upper half. When Dr. Groves saw her, an hour later, she complained of great pain in the abdomen, but now mainly in the lower half, and rigidity and tenderness were most marked below the umbilicus. The pulse was 120, the temperature was 99 2° F., and the respirations were 28. There were no pulmonary signs. It was feared that perforation had occurred. One eighth of a grain of morphine and hot applications were ordered and a consultation was sought with Dr. R. B. Duncan. He agreed in the diagnosis of perforation, but counselled further delay before operating, as the patient was suffering too much from shock. The pulse was 136, the temperature was 102°, and the respirations were 28. Later in the afternoon she seemed a little better generally, but the pain and the abdominal tenderness and rigidity remained as marked as ever, particularly below the umbilicus. The liver dulness was normal, but there appeared to be moveable dulness in the flanks. The respirations were now somewhat hurried, though no pulmonary signs could be found, and the face was rather flushed than pale—important facts in the light of subsequent events, to which insufficient importance was attached. At 8 P.M. the abdomen was opened below the umbilicus. No free fluid could be found. The appendix was normal. On following the ileum upwards at a distance of a few feet from the cæcum there were found 2 feet of empty bowel with shrunken puckered walls and paler than the rest of the intestine—a condition which might be described as "enterospasm." As nothing more could be found another incision was made above the umbilicus, but careful examination again revealed no lesion. The wounds were closed and the patient on leaving the table had, if anything, improved. As the "enterospasm" would not account for the symptoms, the possibility of pneumonia was for the first time seriously considered. During the night the pulse was 136, the temperature was 105°, and the respirations were 48, and some cough was observed. Next day the main symptoms of pneumonia—disturbed pulse-respiration ratio, high temperature, short cough, and flushed cheeks—were present. But there was no expectoration and no definite signs could be found. During the following night the temperature fell by crisis to normal, and next morning distinct signs of consolidation were found at the right base, although any pain complained of at the onset was in the left side of the chest. Convalescence was uninterrupted. This is not the first time that a futile laparotomy has been performed in thoracic disease. In Mr. Barnard's paper is recorded the case of a girl, the subject of gastric ulcer, who was seized in the street with violent epigastric pain and vomiting. She was taken to the London Hospital in a state of collapse. The abdomen was rigid, motionless, very tender, and distended, and these signs were most marked in the epigastric region. Laparotomy was performed, but no sign or trace of gastric ulcer could be found. On the third day there were signs of right basal pneumonia. Death occurred on the fifth day and the necropsy showed double basal pneumonia and right diaphragmatic pleurisy. In the stomach was a shallow ulcer. The only point which should have aroused suspicion was the temperature of 104·5°, unless it was the number of respirations, which unfortunately was not recorded. Dr. Groves suggests that in his case, instead of the abdominal symptoms being directly "referred" effects of the pulmonary lesion, as is usually held, the "enterospasm" was the referred condition and produced the abdominal symptoms. Dr. Duncan agrees with this, and refers to the fact that in several cases operation has been performed for enterospasm. The suggestion that the abdominal symptoms of thoracic disease may be due to enterospasm appears to be new, though Mr. Barnard, with his usual accuracy, pointed out that visceral signs distributed along the whole alimentary canal occur, and noted among these paralysis of the intestines causing abdominal distension.

[1] THE LANCET, August 2nd, 1902, p. 280.

AN ANTIVACCINATION BILL.

A BILL to repeal the Vaccination Acts has been introduced into the House of Commons by Mr. A. W. Black. In three brief clauses and a schedule it proposes to repeal all Acts and portions of Acts that give legal effect to vaccination, to forbid the expenditure of any public money, national or parochial, on the practice or material of vaccination, and to prohibit the requirement of vaccination as a prerequisite to

employment in any Government, public, or parochial service, or to attendance at, or employment or service in, "any public institution, charity, hospital, or school." Mr. Black's suggestions for legislation are short and silly.

A UNIVERSAL GAZETTE OF MEDICAL LITERATURE.

WE have received from the Claudius-Verlag Amandus M. F. Martens, of Wandsbeck, the preliminary announcement of the *Bibliographische Monatsschrift*, an international gazette of universal medical literature, under the editorship of H. Albert-Hellmers, which will appear in 12 parts yearly at an annual price of 30 marks (or 20 marks cash). Each issue will appear about the middle of the month and will contain a list of (*a*) all newly issued books, and (*b*) all important articles appearing in the technical journals, indexed by titles and by authors. There is no periodical publication covering the same ground and keeping pace with current literature. The splendid index-catalogue of the Surgeon-General's Library at Washington appears only at long intervals and in book form. It is questionable whether indexing by title is as good as indexing by subject with frequent cross references. For instance, to take a case from the sample pages submitted with the circular:—"Effects, the, upon the heart of soluble digitoxin, an isolated glucoside of the digitalis group," would be of little service when indexed under "E" as "Effects" to one seeking information about the heart or about digitoxin, both of which would easily be found in a subject-index. We note also that out of eight columns of title references only 16 references, or half a column, are to English literature. This is a defect that would have to be remedied if it were desired to attract an English-speaking *clientèle*. There can be no doubt, however, that there is room for a satisfactory periodical publication on these lines. A fairer judgment can be made of the enterprise when the first part is available for inspection.

WE regret to announce the death, on April 12th, at the advanced age of 84, of Dr. William Ogle, who was for 23 years superintendent of statistics in the General Register Office, and made many important contributions to the science of medical statistics. We hope to publish an obituary notice of Dr. Ogle in an early issue.

INTERNATIONAL MORAL EDUCATION CONGRESS.—Under the patronage of the Queen Mother of the Netherlands and with Prince Henry of the Netherlands as Honorary President the Second International Moral Education Congress will be held at the Hague from July 29th to August 3rd. Great Britain, India, the principal countries of Europe, Japan, and the United States will be represented, and according to the preliminary programme the first aim of the Congress will be to cultivate the coöperation of men and women representing different schools of thought in matters of education and the formation of character. Mr. F. Charles, 22, Park-crescent, Church End, Finchley, London, is the honorary secretary for Great Britain.

LITERARY INTELLIGENCE.—Mr. Stephen Paget, the honorary secretary of the Research Defence Association, has written a book summarising in ten chapters the evidence given before the recent Royal Commission on Vivisection, as well as the inspector's report for 1910. The volume contains in a final chapter a brief account of the report of that Commission, and an introduction by Lord Cromer. The book will be published by Mr. H. K. Lewis.—New editions of Hutchison and Rainy's "Clinical Methods" and Mitchell Bruce's "Materia Medica" are announced for publication early in May by Messrs. Cassell and Co. In the revision of "Materia Medica" Dr. Mitchell Bruce has had the collaboration of Dr. Walter J. Dilling, lecturer on pharmacology in the University of Aberdeen.

TREATMENT BY MEANS OF MECHANICAL THERAPEUTICS AT THE EDGAR ALLEN INSTITUTE, SHEFFIELD.

BY RODOLPH ABERCROMBIE, M.D. CAMB.,
MEDICAL DIRECTOR, EDGAR ALLEN INSTITUTE FOR MEDICO-MECHANICAL TREATMENT, SHEFFIELD.

THE Edgar Allen Institute has been established for the purpose of carrying out, as a charitable institution, various forms of physical treatment, more particularly treatment by means of mechanical therapeutics. The form of mechanical apparatus used is that designed by Dr. Zander, of Stockholm, who is justly regarded as the originator of this method of treatment. In general terms, it may be said that the apparatus is designed to carry out by mechanical means the various movements and manipulations which make up the Swedish system of physical treatment.

The apparatus consists of three groups. In the *first* for *active movements* the patient performs the particular movement against the resistance of a weight and lever; in the *second* for *passive movements* the movement (e.g., flexion and extension or circumduction of a joint) is carried out by a power driven apparatus, without the aid of the patient's muscles; and the *third group* is for mechanical operations, as percussions or vibrations. All the apparatus are exactly graduated, so that the physician can regulate the force and range of the movement, and can prescribe the *dosage* of his treatment, instead of leaving it (as he must do when manual treatment is employed) to the judgment of the masseur. This exact graduation is of especial service in dealing with such conditions as impaired joint mobility or muscular paresis, for it enables the force of the treatment to be increased, step by step, as the patient's condition improves.

Economic considerations constitute one of the advantages of mechanical treatment; for after the initial expenditure for apparatus mechanical treatment can be carried out much more cheaply than similar treatment performed by hand, especially when large numbers of patients are dealt with.

Although the apparatus can do much, in certain of the manœuvres of massage proper, nothing can replace the human hand. At the Sheffield Institute the treatment is supplemented in certain cases by massage given by trained Swedish masseurs. The number of patients treated at present is about 100 a day.

Injuries.—Owing to the industrial nature of the population the results of fractures, dislocations, and other severe injuries of the limbs form a large proportion of the cases. Such cases do not usually come under treatment until a period measured in months has elapsed after the time of accident. Much of the residual disability depends on adhesions about joints or tendons and on muscular paresis. In such conditions the Zander treatment has been found an effective method of restoring the patient's working capacity. Considerable improvement has even been obtained in cases in which the disability has lasted for several years. Adhesions are treated by passive movements of the affected joint, the range of movement being gradually advanced as the condition improves. In treating painful joints mechanical treatment possesses the following advantage: when such a joint is being moved *by hand* the manipulator, actuated by a desire for the patient's good, is tempted occasionally to summon up a vicarious heroism, and make a sudden increase in the excursion of the movement. The patient is always on the watch for acts of benevolence of this nature, and keeps his muscles in a state of contraction in order to frustrate them. Thus the manœuvre is rendered less effective and more painful. On the other hand, when the movement is performed by a *machine*, the patient knows that the range of movement is definite; he therefore confides himself to the apparatus and relaxes his muscles, and the movement is often performed with remarkably little pain.

For weakened muscles, active movements are used against the resistance provided by a weight and lever. An ingenious use is made of the principles of the lever in the Zander apparatus. At the beginning of a movement, when the muscle is fully elongated and therefore weak, the lever is inclined *downwards* from the horizontal, so that the resistance is small; half way through the movement, when the muscle is half contracted, and therefore strongest, the lever